

Liquefied natural gas construction projects gain momentum

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Interest in LNG regasification terminals and storage capacity is gaining momentum in the US. Several projects, either new-builds or expansions, are under serious consideration.

Historically, only about 1% of US natural gas consumption has come from LNG due to liquefaction and transportation costs. However, reduced costs of regasification and improved transportation methods have made LNG imports more attractive. Indeed, some analysts predict as much as a 10% increase of LNG usage over the next 10 years. Because current domestic terminal capacity is only 5 bcfd, it makes sense that new facility construction and expansion plans have begun in earnest this year.

This article describes planned and ongoing engineering and construction projects in the downstream oil, petrochemical, and natural gas processing industry. Specific details of each project follow in the Worldwide Construction Update.

Refining

Not surprisingly, the hunt for clean fuels technology has generated many new and expansion projects in the refining sector. Hydrotreating and desulfurization projects are under way in most countries, along with new hydrogen and sulfur units for support. Sour crude processing with severe operating conditions is the norm.

Petroleo Brasileiro SA (Petrobras), for example, plans to build diesel hydrotreating units to produce low sulfur motor fuels at its Duque de Caxias, Gabriel Passos, and Presidente Vargas refineries. At an expenditure of \$530 million, those units will provide low sulfur diesel to retail stations across Brazil. Petrobras plans to spend \$6 billion in the downstream side of its business by 2010.

Work continues at Murphy Oil USA Inc. Meraux, La., refinery on its Clean Fuels Project. A new gas oil hydrocracker, a deasphalted gas oil hydrotreater, and a central control room move the refinery closer to its goal to produce low sulfur fuels and at the same time reduce emissions.

Although several refineries have shut down operations in the US over the past few years, new, grassroots refineries are planned elsewhere.

In Indonesia, for instance, Gov. Zulkifli Nurdin, Jambi, Indonesia, said he plans to build a greenfield refinery in Jambi province with a total processing capacity of 100,000 b/d. Jambi currently produces only 30,000 b/d so 70,000 b/d must be imported via the Malacca Straits for the yet-to-be-built refinery. A consortium of Sikap Group of Malaysia, Shortin China Oil, and Aldiron Nusantara Co. of Indonesia has been formed to look into the project.

Also in Indonesia, bidders Fluor Daniel, SNC Lavalin, Kvaerner E&C PLC, Caltex Petroleum Corp., and Hyundai Group vie for contract work on a proposed, \$4 billion refinery to be built on Selayar Island in the South Sulawesi province. Plans are ongoing to build processing capacity for 150,000 b/d, with a projected completion date of 2004 if financing is obtained.

And Viet Nam is considering plans to build a second oil refinery in its northern Thanh Hoa province. The first planned refinery, a 130,000 b/d plant in Dung Quat, is funded by PetroVietnam and Russia's Zarubezhneft and should be completed by 2004. If the feasibility study shows the project to be economical, the second refinery would

be built to the same size as Dung Quat.

Petrochemicals

Ethylene projects dominate new petrochemical projects construction in this year's survey. Assuming ongoing projects without cancellations or additions, almost 1.4 MMtpy of new capacity is scheduled to come on stream at the end of 2001. That number increases to nearly 5 MMtpy of new capacity in 2002, with a major portion of that increase contributed by China and India. Following those, several large projects in Iran will increase worldwide ethylene capacity by almost 9 MMtpy in 2003.

On Sept. 28, BASF-YPC Co. Ltd., Nanjing, China, announced a joint venture petrochemical complex to be built on its 220-ha site on the Yangtze River. With a total investment of \$2.9 billion (including utilities) BASF-YPC is currently the largest chemical Sino-German joint venture in China, and this is the first international joint venture for YPC's parent company, Sinopec, since its IPO in 2000. The site is expected to begin commercial operations in 2005 and will produce 1.7 MMtpy of high quality chemicals and polymers to serve the domestic market.

Elsewhere, Jam Petrochemical Co. (JPC), expects to commission its 1.4 MMtpy ethylene plant in Assaluyeh, Iran, in 2003. JPC claims it will be the world's largest ethylene stream-cracker capable of using both natural gas and liquid feedstocks.

Although feasibility studies are not yet completed, Shell Chemical Co., Sumitomo Chemical, and Mitsui Chemicals are in talks to develop an ethylene complex in Singapore. If the consortium is approved, the project is expected to carry a \$1 billion price tag.

Conversely, another option is for Shell to go it alone in Singapore, creating a competition with Sumitomo Chemical and Mitsui Chemicals. Sumitomo and Mitsui are planning a merger that is expected to be finalized in 2003.

Gas-to-liquids

Worldwide undiscovered natural gas resources are estimated to be more than 2,000 tcf, according to the current USGS World Energy Assessment Team summary (www.usgs.gov). By all reports, a major portion of those reserves, nearly 900 tcf, is considered to be stranded gas located far from markets and transportation networks. Monetizing those assets is the 21st century challenge.

The amine regeneration unit at Polski Koncern Naftowy Orlen SA in Plock, Poland, is part of the HDS project, currently under construction, for ultralow sulfur diesel. Photo courtesy of ABB Lummus Global.

As OPEC continues to stabilize oil prices above the upper teens, GTL becomes an economically attractive option for clean fuels strategies.

Responding to the challenge, PGS Production Ltd., Aberdeen, and Syntroleum, Tulsa, recently signed a letter of intent to pursue a joint venture to develop, market, and operate mobile offshore GTL production facilities. In addition to the various onshore GTL plants listed in this survey, GTL technology could become applicable for offshore developments regardless of the size of the field.

As opposed to onshore NGL and regasification facilities that produce energy for power plants, the floating GTL facilities would convert normally stranded or flared natural gas into clean synthetic crude or motor fuels such as diesel and jet fuel.

Current studies by the PGS/Syntroleum joint venture for potential projects and markets are in progress. FPSO or barge-mounted designs producing 5,000-10,000 b/d are the delivery systems proposed for the technology.

Meanwhile, onshore in the Middle East, Qatar Petroleum and ExxonMobil Corp. signed a letter of intent to conduct a technical feasibility study for a proposed GTL project in Qatar. The plant is to convert North field natural gas into diesel, naphtha, and lube base stock for export.

In South America, GTL Bolivia SA signed an MOU with Rentech Inc., Denver, to license technology for a 10,000 b/d GTL plant. Execution of a licensing agreement is pending.

Gas processing

Betting on the projected increase in demand for imported LNG, Southern LNG Inc., a subsidiary of El Paso Corp., has requested quotes from various E&C companies to add 80% additional capacity to its Elba Island, Ga., liquefied natural gas receiving terminal. The facility, shut down since 1982, will be reopened to send out design capacity of 440 MMcfd in 2003, and reach final capacity of 800 MMcfd after the expansion is completed.

Chenier Energy, Inc., Houston, announced on June 12 its intention to develop three LNG terminals along the Texas Gulf Coast. The annual target capacity is 200 bcf per terminal with an estimated cost of \$300 million/site. Operations are expected to begin at all three facilities within 6 years. Chenier Energy's first confirmed site, on Quintana Island near the Port of Freeport, Tex., was chosen for its existing pipeline infrastructure and harbor facilities. The site was purchased from original developer, Crest Investment Co. The second site is on 125 acres at the Port of Brownsville. This site is touted as an excellent location to serve energy needs in both Texas and Mexico.

Elsewhere, work continues on one of the largest liquefied gas plant in the world, the 9.6 MMt/y LNG plant at the Sakhalin-2 oil and gas project. Project planning is continuing for the oil and gas export terminals, and Sakhalin Energy is expected to invest another \$500 million this year.

Atlantic LNG Co., Trinidad and Tobago, has awarded the front-end engineering and design contract to Bechtel Overseas Inc. for work on the fourth LNG train at Point Fortin. The facility is currently constructing two process trains to triple the site's capacity. Those trains should be completed by 2003. Adding the fourth train will bring the plant's capacity to 14.4 MMt/y

The external cyclone system is lowered onto the second sta regenerator of the 26,300 b/d RFCC at Indian Oil Corp. Ltd., Barauni Refinery, Bihar, India. Photo courtesy of Stone & Webster Inc., a Shaw Group Co.

Sulfur

Sulfur recovery unit (SRU) construction is on the rise, due not only to stricter motor fuel specifications but also to increasingly sour crude feedstocks on the market. Over the past 5 years in the US, the sulfur content of crude oils has increased at a rate change of 0.56 wt%/year, according to Ed Swain, consultant, Houston. If the trend continues, an additional 916,900 tonnes of sulfur will be recovered from refinery process streams by the end of 2003.

Factoring in upcoming EPA fuel specs, low quality feedstock estimates, and other criteria, the current SRU capacity utilization rate could increase to 84% from the 1999 level of 67%. Additional SRU capacity would be needed to reduce the utilization factor back down to the 75% optimal utilization level.

In addition to the US expansions, several new large projects are under construction in the Middle East, Latin America, and Europe.

Iran's National Iranian Oil Co. reports seven SRU projects in various stages of planning, engineering, and under construction.

Petroleos Mexicanos lists four projects currently under construction with an expected completion date of 2002.

Resold-YPF, Madrid, also has projects designed to increased capacity, with the majority to be completed at the end of this year.

Pipeline

In the US, the Senate Committee on Energy and Natural Resources held an Oct. 2 hearing to consider pending proposals to build a natural gas pipeline between Alaska and the Lower 48. Alaska Gov. Tony Knowles continues to advocate that the pipeline follow the Alaska Highway route and has proposed tax incentives to support the project. If built, the venture could cost up to \$20 billion, making it one of the largest construction projects in American history.

The Interstate Natural Gas Association of America assessed the commercial feasibility and concluded that the pipeline project would provide long-term economic benefits with minimal environmental impact.

An alternative route, the proposed Mackenzie Valley pipeline route, would transport natural gas reserves from the Northwest Territories to market via a Beaufort Sea pipeline.

In other pipeline developments, ExxonMobil took control of the Papua New Guinea-to-Queensland natural gas pipeline project from project partner Chevron Corp. The \$ 3.5 billion proposed pipeline is expected to commence operations in 2003.

In Ecuador, talk continues regarding the Oleoducto de Crudos Pesados SA (OCP Ecuador) 312-mile pipeline planned to link Lago Agrio to Esmeraldas on the coast. OCP Ecuador is a multinational conglomerate led by Spain's Repsol-YPF. Although the pipeline was planned for a June 2003 completion, environmentalists are delaying construction by protesting possible ecological damage that may result from both construction and completion of the project.

Fueling those concerns is damage to Ecuador's largest pipeline. That pipeline was cracked during a mudslide and spilled 8,000 bbl of oil into a river.

The newly proposed pipeline project faces possible delays as Petroecuador, the state oil company, undergoes discussions concerning safety and environmental hazard precautions with local officials.

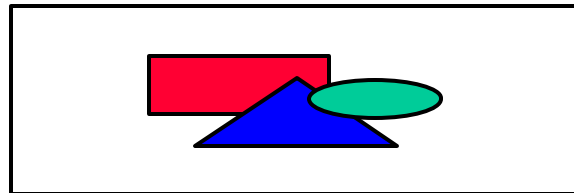
Also embroiled in a social, environmental, and political battle is the Chad-Cameroon pipeline project, a consortium comprised of operator ExxonMobil and partners Chevron and Petronas. Allegations of electoral fraud, human rights abuses, and the misallocation of funds may cause a delay of loans needed for project completion, although that hasn't happened to date.

The 663-mile pipeline is intended to move crude from Chad's Doba basin to an offshore loading facility on the Atlantic coast of Cameroon. The Doba basin will produce an estimated 225,000 b/d after project completion.

The World Bank, which supported the project at its inception in June 2000, is under pressure to ensure that some level of profits from the \$3.7 billion project benefits the citizens of Chad and Cameroon.

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